Building a Community of Investigators:
The Causal Analysis/Diagnosis Decision Information System (CADDIS)

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Increasingly, the regulatory, remedial and restoration actions taken to manage impaired ecosystems are based on measurement and analysis of the biotic community. When an aquatic community has been identified as impaired, the cause of the impairment must be determined so that appropriate actions can be taken. The Causal Analysis/Diagnosis Decision Information System (CADDIS) is being developed to help investigators in the states, tribes and regions access, analyze and share information useful for causal analyses. This poster describes the collaborative activities that have influenced the design and future plans for CADDIS, including case-study workshops and training sessions. User feedback has been used to direct the project toward developing stressor-response relationships from literature syntheses and regional data sets. By sharing data useful for causal analysis and experiences in conducting these assessments, we aim to build a community of investigators that can confidently identify the causes of biological impairment in streams. By accurately identifying the causes of impairment, we can ensure that management activities are directed towards actions that will truly improve the condition of the nation's waters.

Meeting Agency & Scientific Needs

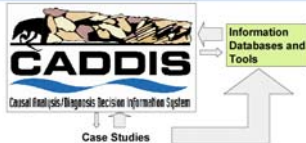**Why did this aquatic community change. . .**

Low dissolved oxygen?
Fine sediments?
Excess nutrients?
Toxic substances?
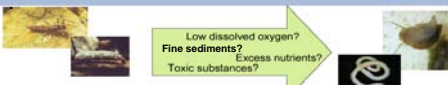
From mayflies and caddisflies that indicate high environmental quality. . .

. . .to snails and worms that indicate poor environmental quality?

- Over a thousand US waters are listed by states as biologically impaired. For many of these, the cause of the impairment is also reported as "unknown".
- Before an appropriate management action can be designed, the cause of the biological impairment, for example, excess fine sediments, nutrients, or toxic substances, must be determined.
- Defensible causal analyses require knowledge of the mechanisms, symptoms, and stressor-response relationships for various specific stressors as well as the ability to use that knowledge to draw appropriate conclusions.

- CADDIS is a web-based decision support system that will help investigators in the regions, states and tribes find, access, organize and share information useful for causal evaluations in aquatic systems.
- It is based on the USEPA's Stressor Identification process, which is a formal method for identifying causes of impairments in aquatic systems. It features:
  - A step-by-step guide to conducting a causal analysis,
  - Downloadable worksheets and examples,
  - A library of conceptual models, and
  - Links to helpful information

CADDIS will help investigators determine causes by bringing together guidance, tools, information and case experiences

CADDIS
Causal Analysis/Diagnosis Decision Information System

Information Databases and Tools

Case Studies

Current Knowledge & Capability

CADDIS website, http://www.epa.gov/caddis/ :

Online databases, e.g. conceptual model library:

Ongoing Research & Development

Stressor-Response information from other studies

- Aluminum MAX
- Aluminum
- Chromium MAX
- Chromium
- Iron MAX
- Iron
- Nickel MAX
- Nickel

e.g.,Chromium concentrations are below those associated with effects in other studies

Stressor-Specific Tolerance Values

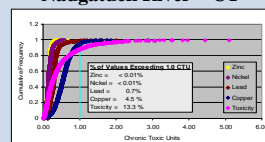e.g., Acentrella would not be expected at acidified sites

Acentrella

Oulimnius

Lepidostoma

Case Study Examples

Willimantic River – CT

Model Development Using Advanced Arcview

- Unknown cause and source identified (illicit discharge from broken industrial effluent pipe)
- Documented biological remediation
- Removed from the 303d list
- Second iteration identified another potential cause that, when remediated, could further improve biological condition

Naugatuck River – CT

% of Values Exceeding 1.0 CTU	
Zinc = < 0.01%	Zinc
Nickel = < 0.01%	Nickel
Lead = 0.7%	Lead
Copper = 4.5%	Copper
Toxicity = 13.3 %	Toxicity

- Case with multiple sources and decreasing condition below each source
- Applied toxicity tests and modeling to support case
- Mixture of toxic substances identified as probable cause
- TMDL recently approved

Urban streams nonpoint source assessments in Maine, final report (MEDEP, 2005)

Barberry Creek South Portland

Trout Brook South Portland and Cape Elizabeth

Birch Stream Bangor

Capisic Brook Portland

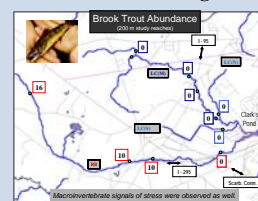### Stressor Identification for Bogue Homo – Jones County, MS

December, 2004

- Set of many similar cases
- Reuse of template to speed assessments
- Identified low dissolved oxygen and excess sediment

Touchet River – WA

- Agricultural example
- Arid eastern Washington
- Project team used conceptual models and graphical representations

Long Creek – Maine

Brook Trout Abundance (200 m study reaches)

Macroinvertebrate signals of stress were observed as well.

- Small watershed case study
- Urbanized system
- Flow alteration and temperature are key stressors
- Ongoing case study effort